A Research of Critical Factors in the Cloud Service Approach

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The purpose of this study is to find out how to manage knowhow in an old company with a new service. There are many different matters of concern when launching a new service on the market. That is why the aim of this study was to give priority to areas in managing the knowhow and thus support the management to aim in the right direction from the very beginning. This can also work as a competitive advantage for the new service. The point of view has been gained from management students who are experienced in business life. The group members had a realistic basis from their experiences to compare the existing systems to this new one. The chosen view can also help an existing company to see its own functions and processes in a new way, which tends to become difficult after years of operation. This leads to another positive aspect – improvement and developing. The study is based on the Critical Factor Index method which had here a different function than it usually does. Basically all the other results given by the Critical Factor Index are based on a questionnaire inside the companies. In this case, the study was carried out by using external experts. The aim of the study was also to find out the differences pointed out between different answering groups: managers, sales personnel and experts.

Key words: decision making, operations strategy, resource allocation, critical factor index (CFI), service developing, cloud service, rental software

Introduction

The research group was interested in testing what results the Critical Factor Index (CFI) method would give in management of new and advanced service. Cloud service is an innovative project which started in March 2009. The purpose is to create a guaranteed connection of one hundred megabits for every home and desk in Finland. The project aims to offer a virtual desk of high quality when using the TV-channels, games, video negotiation and other applications. About 150 experts from nearly a hundred companies are taking part in creating new services and applications for cloud service.

Cloud service brings a very fast connection of data transmission at home usage. This makes it possible to order a computer, software and TV-channels from a cloud service supplier. The customer needs only a keyboard, mouse and screen which will be connected to the adapter of broadband line. The service can be ordered from a local operator and will be built and installed by professionals who also will take care of the virus protection software and installations of updates for the operating system, regular back-up copying, saving files and many other things. The target of the service is to offer an easy, fast, confident and carefree way to use the computer and its applications. The existing companies in this case are current operators, software and applications.

The study was made to find answers to questions: what kind of results does the Critical Factor Index (CFI) method give when using an outside expert group and what are the main points to focus on in managing cloud service? By the results of the CFI method, the aim was to find the challenges in managing knowhow and launching.

The study has been done by using the CFI (Critical Factor Index) method, which has been used in other cases before. The idea of applying CFI came while studying an article 'Developing Resource Allocations in New Product Development by Critical Factor Index' written by Elina Latva-Rasku and Josu Takala.

First the CFI method was studied to define and calculate CFIs fitted for the chosen case. The case in this study was cloud service. When the CFIs are found out, conclusions are made about which things with the cloud service concept needs to have more management actions than the others. The aim is to find out the most challenging factors when company management to gives priority the resources connected to cloud service functions (to give the company management information to help the managers to gives priority to their resources at the most alarming spots).

Methods and Examples of the Results

To find the critical factors for the cloud service concept, a study was made by utilizing the CFI method developed by Rautiainen and Takala (2003) and Ranta and Takala (2007). The basic idea of CFI is to compare expectations and experiences and is applied in this study for research of cloud service and other technologies. The CFI method assumes the user to define attributes, which are connected to chosen main themes in the product or service in focus.

The CFI method focuses also on analyzing ideas about what kind of future or development the company is expected to have for dif-

1. *Gap index* = $|(\textit{average of experience} - \textit{average of expectation})/10 - 1|$
   Average of experience = 8.75
   Average of expectation = 9.45
   Direction of development: worse (w) = 34%, same (s) = 43%, better (b) = 23%
2. *Direction of development index* = $|(b - w)/100|$
3. *Importance index* = (*average of expectation*)/100
4. *Critical factor index* (CFI) = ((*st. dev. of expectation*) × (*st. dev. of experience*))/((*importance index*) × (*gap index*) × (*direction of development index*))

FIGURE 1 CFI calculation formulas (Latva-Rasku and Takala 2008)

ferent attributes: worse, same or better than the situation at the moment. Typically named in the questionnaire is the time period of concern. The examined time period in this study was five years. The CFI method has been used as shown in Latva-Rasku and Takala (2008). The formulas are shown in figure 1. CFI calculation formulas (Latva-Rasku and Takala 2008).

The material is based on a questionnaire, which was carried out among the company managers, sales managers and experts. The questionnaire consisted of 22 different attributes in 3 different groups. Three groups were identified to find out the value of customers for the cloud services. On that basis the target groups were named. The groups were 1 Customers, 2 Products and 3 Resources and Technologies.

After having named the groups in interest for the cloud service evaluation, there were found out different attributes among these three groups. The attributes characterize more precisely the desired issues inside a group as well as the identified facts managed. Those issues are already managed or are desired to be managed, but their importance is found out by using them as attributes in the CFI method. After holding attributes evaluation sessions, the ones seen to be relevant for the service supplier were pointed out as attributes. To be able to handle properly the attributes, an amount of 5 to 10 per group can be recommended, although there are no limitations for the attribute amount.

In this study the first group 'Customers' had 5 attributes, the second group 'Products' 8 attributes, and the third group 'Resources and Technologies' 9 attributes. In the group 'Customers' the question asked was how important (scale 1–5) the company should consider the following factors regarding customers: wide range of customers, turnover of client, location of customers, customer needs and their understanding and finally, how important it is for the company that

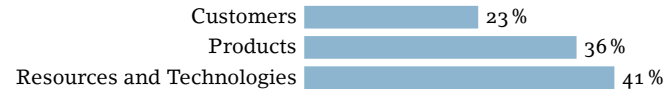

FIGURE 2 Distribution of questions for CFI questionnaire of cloud service concept

it will be identified on the market. When finding out the critical factors in the group 'Products,' the questions were asked about branding, pricing, delivery, introduction, subcontractors, distribution, supplementary service and amount of new products. In the group 'Resources and technologies' the questions were about knowledge on telecommunications, IT, software, information security, production and invoicing system, logistics, finance, process and meaning of supplementary service and technology partners. All the groups and attributes are given in table 1 and the distribution of questions is shown in figure 2. The questionnaire was weighted on 'Products and Resources' by having slightly more questions on these two groups.

Three calculation rounds were made because of irrelevant CFI values. The first values were too big in scale; the second ones had negative CFI values mixed with the correct ones. The last calculation round produced the correct CFI values in correct scales. Irrelevancies in calculation were found to appear due to inaccuracies of the formulas in the reference material.

The aim of this study was also to find out the differences pointed out between different answering groups: managers, sales personnel and experts. The questionnaire failed to produce this information, because of the large amount of uncompleted answer sheets. Irrelevant material in this sense made the researchers' group decide to drop this comparison.

Results

The questionnaire was sent to 32 persons who were chosen carefully due to their background and knowledge. The responses were received from 22 persons. The response rate amounted to 69%, which can be considered to be fairly high. In table 1 there are given all the attributes, gap indexes, directions of development indexes, importance indexes and CFIs. These results are explained later.

The importance index varied between 0.57 and 0.95. The study was focused on the highest one-third of the indexes and it gave the weight point of 0.90. It resulted in one important attribute in group 1, one important attribute in group 2 and four important attributes in group 3. Totally the questionnaire analysis ended in six important at-

TABLE 1 Critical factor index questionnaire preliminary analysis

Questions		(1)	(2)	(3)	(4)
Customers					
1	Large quantity of customership	−1.12	−0.996	0.86	1.63
2	Turnover of individual customer	−1.02	−0.994	0.69	4.35
3	National or local customership	−0.96	−0.997	0.57	6.84
4	Understanding of customers' needs	−1.15	−0.992	0.95	0.54
5	Identifying of service provider at market	−1.08	−0.992	0.86	1.76
Products					
6	Level of productization	−1.12	−0.993	0.88	2.07
7	Pricing constructions and models	−1.10	−0.997	0.80	1.86
8	Delivery of total service(equipment and software)	−1.13	−0.995	0.88	1.73
9	Easiness of introduction	−1.11	−0.994	0.92	0.90
10	Subcontracting's large proportion of operation	−0.96	−0.997	0.61	6.37
11	Distribution of services locally	−1.04	−1.000	0.71	3.89
12	Supplementary service (installation and support service) of turnover	−1.07	−0.993	0.69	5.02
13	Large quantity of new products (e. g. Leasing of software)	−1.12	−0.993	0.71	5.56
Resources and Technologies					
14	Knowhow of telecommunication	−1.09	−0.994	0.92	1.11
15	Knowhow of IT	−1.10	−0.994	0.93	1.01
16	Knowhow of software	−1.11	−0.996	0.90	2.10
17	Knowhow of information security	−1.13	−0.993	0.94	1.01
18	Knowhow of production and invoicing system	−1.06	−0.999	0.73	2.76
19	Knowhow of logistics	−1.05	−0.996	0.76	291
20	Knowhow of finance	−1.06	−0.997	0.73	3.32
21	Knowhow of process	−1.06	−0.996	0.80	3.00
22	Meaning of supplementary service and technology partners	−1.08	−0.994	0.83	1.71

NOTES Column headings are as follows: (1) Gap Index, (2) Direction of Development Index, (3) Importance Index, (4) Critical Factor Index.

tributes, which were mainly connected with group 3 and knowledge connected with IT (software, information security etc.). Regarded as important attributes were the following:

- in group 1: attribute 5 'Identifying of service provider at market,'
- in group 2: attribute 10 'Subcontractor's large proportion of operation,'
- in group 3: attributes 15 'Knowhow of IT,' 16 'Knowhow of soft-

ware,' 17 'Knowhow of information security' and 18 'Knowhow of production and invoicing system.'

The four smallest Critical Factor Indexes can be found in three different groups, while the three biggest ones were concentrated in only two groups as seen in table 1 (column 4). There were four small CFIs instead of three because of the equal numerical value, which was 1.01 for two different attributes.

The smallest CFIs fell among four different attributes:

- in group 1: attribute 4 'Understanding of customers' needs,'
- in group 2: attribute 9 'Easiness of introduction,'
- in group 3: attributes 15 'Knowhow of IT and 17 Knowhow of information security.'

The above attributes should be taken into consideration and are most critical in management.

The biggest CFIs fell into three different attributes:

- in group 1: attribute 3 'National or local customership,'
- in group 2: attributes 10 'Subcontracting's large proportion of operation,' and 13 'Large quantity of new products.'

The attributes do not significantly affect managerial choices.

The future development analysis of this study's attributes is based on table 2. The future of the cloud service studied is evaluated as Worse if the defined attribute is expected to develop worse than it is at the moment. Likewise the category Same indicates the future to be the same as at the moment of the questionnaire, and Better indicates the future to be better. The time period was expected to be five years.

Most of the answers fell into the category Better, which had 247 remarks to be shared between the 22 attributes. The category Same got 190 remarks, and only 20 remarks were given to the category Worse. The top three in different categories were:

1. Better:
   - attribute 4 'Understanding of customers' needs,'
   - attribute 5 'Identifying of service provider at market,'
   - attribute 12 'Supplementary service.'
2. Same:
   - attribute 7 'Pricing constructions and models,'
   - attribute 18 'Knowhow of production and invoicing system,'
   - attribute 20 'Knowhow of finance.'
3. Worse:

TABLE 2 Development of the future of the cloud service concept, deviation on categories Worse, Same and Better

Questions		Worse		Same		Better	
Customers							
1	Large quantity of customership	3	14,29%	6	28,57%	12	57,14%
2	Turnover of individual customer	2	10,00%	4	20,00%	14	70,00%
3	National or local customership	1	5,56%	10	55,56%	7	38,89%
4	Understanding of customers needs	0	0,00%	5	22,73%	17	77,27%
5	Identifying of service provider at market	0	0,00%	4	18,18%	18	81,82%
Products							
6	Level of productization	0	0,00%	6	30,00%	14	70,00%
7	Pricing constructions and models	0	0,00%	15	71,43%	6	28,57%
8	Delivery of total service (equipment and software)	0	0,00%	10	47,62%	11	52,38%
9	Easiness of introduction	1	5,00%	6	30,00%	13	65,00%
10	Subcontracting's large proportion of operation	3	14,29%	9	42,86%	9	42,86%
11	Distribution of services locally	5	25,00%	10	50,00%	5	25,00%
12	Supplementary service (installation and support service) of turnover	2	9,52%	2	9,52%	17	80,95%
13	Large quantity of new products (e. g. leasing of software)	2	9,52%	3	14,29%	16	76,19%
Resources and Technologies							
14	Know how of telecommunication	1	4,76%	6	28,57%	14	66,67%
15	Know how of IT	0	0,00%	9	40,91%	13	59,09%
16	Know how of software	0	0,00%	13	61,90%	8	38,10%
17	Know how of information security	0	0,00%	7	33,33%	14	66,67%
18	Know how of production and invoicing system	0	0,00%	17	85,00%	3	15,00%
19	Know how of logistics	0	0,00%	14	63,64%	8	36,36%
20	Know how of finance	0	0,00%	14	70,00%	6	30,00%
21	Know how of process	0	0,00%	11	55,00%	9	45,00%
22	Meaning of supplementary service and technology partners	0	0,00%	9	40,91%	13	59,09%

- attribute 1 'Large quantity of customership,'
- attribute 10 'Subcontracting's large proportion of operation,'
- attribute 11 'Distribution of services locally.'

The comparison of averages given in the questionnaire is shown in figure 3. The averages are calculated for every 22 attributes separately and for three different views: expectations, experiences and competitors. The patterns of the average curves were nearly the

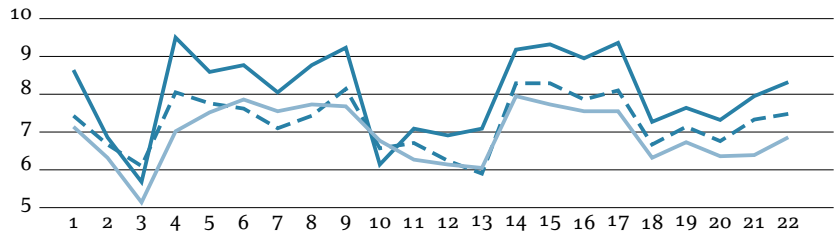

FIGURE 3 Comparison of the averages given in the questionnaire (from top to bottom: expectations, experiences, competitors)

same, when having a look at expectations, experiences and competitors. The highest expectation was placed on attribute 4 'Understanding of customers' needs,' which was fulfilled better by experiences from cloud service than by ones from competitors. The lowest expectations were placed on attribute 3 'National or local customership', and the answers of the experience from both cloud service and its competitors were analogous. As groups, the highest expectations are on products, resources and technologies. Both the experiences of cloud service and competitors did not achieve the level of expectations, where those expectations are the highest ones. The gap is quite big and these points are taken into the list of improvements. Cloud service is seen to be roughly on the same level as its competitors on the average curve of attributes.

Review of CFI in Different Groups

'Resources and technologies' get a lower critical factor index than the two other groups; 'Products' and 'Customers.'

The most critical factor in the group 'Resources and technologies' was on attributes Knowhow of IT and Knowhow of information security. Both attributes were experienced as being important today and were expected to be more important in the future. No one expected the importance of these two attributes to decrease.

Knowhow of IT is increasing continually and people do not hang on to development. That is why it is felt as being important even in the future and as a critical factor today. Know how of information security was also expected to be more important in the future. Lately there has been lot of discussion about security. People are very watchful and feel that security is never enough. It is important to note that the lowest attributes were in the group 'Customers;' understanding of customers' needs and in the group 'Products;' easiness of introduction. In the research, the CFI method raised these attributes to be paid attention in managerial actions.

How to Raise the Level of KnowHow of IT

To increase sufficient expertise, the staff of the company should be offered education in IT, although this requires resources. The costs of education will be paid back in successful processes. A companies can for example purchase completed study program depending on the needs. Company can also choose one or more persons on the staff to have a good knowledge of IT as their responsibility. Excellent education for selected persons is economical and more feasible than to educate everyone on the staff a little.

How to the Raise Level of KnowHow of Information Security

The information security can be improved, for example, by security directions. The communal governing and economic life are already following their own directions in information security. The directions separate the information security hazards into different ranges, according to seriousness and the probability of hazard.

How to Understand Customer Needs Better

It is important to understand customer needs, so that is easier to serve the customer. When the customer service personnel knows well the products and is self confident, then the customers feels faithful and has the right requirements to make the decision to purchase. It is very important for customer service personnel to understand the client's personality and to know how to ask the right questions. Every customer is unlike the other, and every customer should feel that the service is just for him or her.

Professional customer service personnel knowhow is to make conclusions rapidly based on customer needs. Listening to the customer is important and makes it possible to serve a client in an actual situation. It is unnecessary work to offer something that the customer does not want. This is also one of the grounds why the service can be felt not to be good.

It is important to understand why customers buy or use products. The customer has a job to do or problem to solve, and the product is the solution. It is easier to be successful when the company which is providing the service focuses on the situations where the customers use the product, not only directly on the customer. The service providing companies perceive the customer's needs by observing the customers and later asking them. Sometimes the target group could be found by the non-consumers.

How to Ease Introduction

It is most important to have good and clear instructions for use available. Instructions for new personnel should be clear. There should be enough time for them to familiarize themselves with the equipment and learn to understand how it works.

In a lot of cases the helpdesk can help the customer with problems which appear in the introduction. When thinking about the product development, the experiences from the helpdesk should be forwarded to developers. As a whole this requires usage of an information method inside the company.

Conclusions

This study shows that the most critical factors of the cloud service concept are 'Understanding of customers' needs.' 'Easiness of introduction,' 'Knowhow of IT,' and 'Knowhow of information security.' This result indicates that the developers of the cloud service concept have to focus on those four factors in management.

The study method worked quite well in this kind of survey. To receive better results, the introduction of the cloud service concept should have been written more precisely. This would have given more answers than are included on the questionnaire sheets to the survey. The questionnaire included a part called 'Competitors' and this was unclear from the answers too. The comparison with the competitors was dropped due to this failure in the questionnaire.

The management is advised to focus on four points in the company offering and launching the cloud service. Those points are the level of knowledge of IT, the level of knowledge of information security, the understanding of customer needs and how to ease introduction. For the attributes also the expectations were high and therefore should be emphasized in managing.

When planning the future management actions in this case, the researcher's group recommends focusing on discovered weak points by educating the personnel, making resources available to assure the easiness of the concept service, and following the information security directions. The management actions should be focused on technological knowledge and understanding customer needs. This can relate to the fact that consumers are often searching for easy ways to use and understand what they spend their money on. The management students' group saw that customers expect to be served, too.

The deepest differences in answers in the group 'Customers' and in the question of understanding the customer's needs may be based

on the large variety of the management students' backgrounds. Even if they work in companies with large amounts of customers, the variety in their experience influences their views and answers. Also, if the cloud service was not familiar to the respondents, it could cause a high gap too because they probably wanted to highlight that the service is difficult to understand, which can also cause a feeling that the service is difficult to use. The cloud service is a new innovation, and as usually with new innovations, it can be challenging to imagine something that does not yet exist.

There have been found two suggestions for advancing the analysis made here. As the first suggestion, it would be interesting to repeat this study after 2–3 months and find out if the results were same. The expectation would be that the repeated study gives different results. As the second suggestion, it would be interesting to make comparisons between the new concepts studied in this study and some other new concept using the same test group.

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